WHAT IS CLAIMED IS:

1. Process for the preparation of poly(hydroxy fatty acids) with at least one subunit by means of recombinant bacteria which contain and express at least one fragment of the gene of poly(hydroxy fatty acid) synthase from *Thiocapsa pfennigii* and which are selected from the group comprising:

Pseudomonas putida GPpl04 (pHP1014::E156), *Alcaligenes eutrophus* PHB 4 (pHP1014::EIS6), *Pseudomonas putida* GPpl04 (pHP1014::B28+) [DSM # 9417] and *Alcaligenes eutrophus* PHB 4 (pHP1014:B28+) [DSM # 9418], whereby the bacteria are cultivated in a mineral medium under aerobic conditions, whereby

one offers the bacteria at least one substrate carbon source which is selected from the group consisting of:

levulinic acid, salts of levulinic acid, esters of levulinic acid, lactones of levulinic acid, substituted levulinic acid or, as the case may be, its derivatives; 5-hydroxyhexanoic acid, its salts, esters and lactones; 4-hydroxyheptanoic acid, its salts, esters and lactones; 4-hydroxyoctanoic acid, its salts, esters and lactones;

their halogenated derivatives as well as their mixtures;

one incubates the bacteria for a certain time with the carbon source; and

one isolates the poly(hydroxy fatty acid) polymers that have been synthesized by the bacteria.

2. Process in accordance with Claim 1, characterized by the feature that the bacteria are pre-cultivated in a complex medium.

3. Process in accordance with Claim 1 or 2, characterized by the feature that one also adds to the bacterial culture at least one additional carbon source which promotes growth, whereby the carbon source is selected from the group comprising: citric acid, octanoic acid and gluconic acid; their salts, esters and lactones; hexoses, especially glucose and fructose; as well as their mixtures.

4. Process in accordance with one of the Claims 1 through 3, characterized by the feature that the process is carried out in the form of a batch process, a fed-batch process, a two-step process or a continuous flow process.

5. Process in accordance with one of the Claims 1 through 4, characterized by the feature that the poly(hydroxy fatty acid) is obtained in a concentration of approximately 15 to 70% by weight or, especially approximately 15 to 50% by weight or, preferably, approximately 40% by weight based on the dry mass of the bacterial cells.

6. Process in accordance with one of the Claims 1 through 5, characterized by the feature that the poly(hydroxy fatty acids) are obtained in the form of copolyesters with at least two or, preferably, three subunits.

7. Process in accordance with one of the Claims 1 through 6, characterized by the feature that the recombinant bacteria are cultivated at cell densities of up to 100 g of dry cellular mass per liter of bacterial nutrient medium.

8. Process in accordance with one of the Claims 1 through 7, characterized by the feature that one offers the substrate carbon source in excess.

9. Process in accordance with Claim 8, characterized by the feature that one uses the substrate carbon source at a concentration of approximately 0.1 to 5% by weight.

10. Process in accordance with Claim 9, characterized by the feature that one increases the concentration of the substrate carbon source in the culture medium in steps, optionally with pre-cultivation in the presence of an additional carbon source which does not serve as a substrate.

11. Process in accordance with Claim 10, characterized by the feature that, in each case, one adds approximately 0.5% (weight/volume) of neutralized substrate carbon source after approximately 12 h and 24 h at approximately 27°C to 35°C or, preferably, at approximately 30°C.

12. Process in accordance with one of the Claims 1 through 11, characterized by the feature that cultivation takes place for approximately 24 h to 96 h or, especially, for approximately 36 h to 72 h or, preferably, for approximately 48 h to 72 h.

13. Process in accordance with one of the Claims 1 through 12, characterized by the feature that the recombinant bacteria are cultivated under conditions of deficiency, preferably under conditions of a deficiency of nitrogen, magnesium or phosphate.

14. Process in accordance with one of the Claims 1 through 13, characterized by the feature that the harvested recombinant bacteria are broken open by means of physical and/or chemical and/or biochemical processes in order to obtain the poly(hydroxy fatty acids) that have been produced bio-technically.

15. Process in accordance with Claim 14, characterized by the feature that the harvested recombinant bacteria are lyophilized and then extracted with an organic solvent, preferably chloroform or methylene chloride, in order to break open the recombinant bacteria and to obtain the poly(hydroxy fatty acids).

16. Process in accordance with Claim 15, characterized by the feature that the extracted poly(hydroxy fatty acid) product is precipitated by introducing a hydrophilic solvent, especially water or a lower alcohol, preferably ethanol, and the product is obtained in essentially pure form by removing the hydrophilic solvent.

17. Process in accordance with Claim 14, characterized by the feature that the harvested recombinant bacteria are broken open by means of detergents and/or a lytic enzyme cocktail as a result of which the bacterial cell grana, which contain the poly(hydroxy fatty acid), sediment to the bottom of the bio-reactor and are collected from there in order to be processed further.

18. Process in accordance with Claim 17, characterized by the feature that the lytic enzyme cocktail contains enzymes which are selected from the group which comprises:

lysozyme; proteases; other hydrolytic enzymes; as well as their mixtures.

19. Recombinant bacterial strain for the preparation of poly(hydroxy fatty acids), especially for the implementation of the process in accordance with one of the Claims 1 through 18,

characterized by the feature that

the bacterial strain is selected from the group which comprises

Pseudomonas putida GPpIO4 (pHP1014::B28+) [DSM # 9417] and *Alcaligenes eutrophus* PHB 4 (pHP1014::B28+) [DSM # 9418].

20. Bacterial strain in accordance with Claim 19, characterized by the feature that it contains and expresses a minimally small DNA fragment with the gene of the poly(hydroxy fatty acid) synthase from *Thiocapsa pfennigii*.

21. Bacterial strain in accordance with Claim 19 or 20, characterized by the feature that it is capable of transforming at least one substrate carbon source into a poly(hydroxy fatty acid) with at least one subunit and storing this in an intracellular manner, whereby the substrate carbon source is selected from the group which comprises:

levulinic acid, salts of levulinic acid, esters of levulinic acid, lactones of levulinic acid, substituted levulinic acid or, as the case may be, its derivatives; 5-hydroxyhexanoic acid, its salts, esters and lactones; 4-hydroxyheptanoic acid, its salts, esters and lactones; 4-hydroxyoctanoic acid, its salts, esters and lactones;

their halogenated derivatives as well as their mixtures.

22. Bacterial strain in accordance with one of the Claims 19 through 21, characterized by the feature that a thermoplastic poly(hydroxy fatty acid) is bio-synthesized in the form of a copolymer with at least three subunits.

23. Poly(hydroxy fatty acid) which is obtainable using a process in accordance with one of the Claims 1 through 18.

24. Poly(hydroxy fatty acid) in accordance with Claim 23, characterized by the feature that it contains groups of subunits which are selected from the group which comprises:

(A) 3-hydroxybutyric acid, 3-hydroxyvaleric acid and 4-hydroxy-valeric acid;

(B) 3-hydroxybutyric acid, 3-hydroxyvaleric acid, 4-hydroxy-valeric acid, 3-hydroxyhexanoic acid and 3-hydroxyoctanoic acid;

(C) 3-hydroxybutyric acid, 3-hydroxyhexanoic acid, 5-hydroxy-hexanoic acid and 3-hydroxyoctanoic acid;

(D) 3-hydroxybutyric acid, 3-hydroxyvaleric acid, 3-hydroxy-hexanoic acid, 3-hydroxyheptanoic acid, 4-hydroxyheptanoic acid and 3-hydroxyoctanoic acid;

(E) 3-hydroxybutyric acid, 3-hydroxyhexanoic acid, 3-hydroxy-octanoic acid and 4-hydroxyoctanoic acid;

(F) 3-hydroxybutyric acid, 3-hydroxyhexanoic acid and 5-hydroxy-hexanoic acid;

(G) 3-hydroxybutyric acid, 3-hydroxyvaleric acid, 3-hydroxy-heptanoic acid and 4-hydroxyheptanoic acid;

(H) 3-hydroxybutyric acid, 3-hydroxyvaleric acid, 3-hydroxy-hexanoic acid, 3-hydroxyoctanoic acid and 4-hydroxyoctanoic acid;

(I) 3-hydroxybutyric acid, 3-hydroxyhexanoic acid and 4-hydroxy-hexanoic acid; and

(J) 3-hydroxybutyric acid and 5-hydroxyhexanoic acid.

25. Poly(hydroxy fatty acid) in accordance with Claim 24, characterized by the feature that the poly(hydroxy fatty acid) with the subgroup unit (A) has the following quantitative composition:

approximately 35 mol% to 65 mol% of 3-hydroxybutyric acid;

approximately 30 mol% to 50 mol% of 3-hydroxyvaleric acid; and

approximately 5 mol% to 20 mol% of 4-hydroxyvaleric acid.

26. Poly(hydroxy fatty acid) in accordance with Claim 24, characterized by the feature that the poly(hydroxy fatty acid) with the subgroup unit (B) has the following quantitative composition:

approximately 10 mol% to 15 mol% of 3-hydroxybutyric acid;

approximately 40 mol% to 60 mol% of 3-hydroxyvaleric acid;

approximately 10 mol% to 20 mol% of 4-hydroxyvaleric acid;

approximately 5 mol% to 15 mol% of 3-hydroxyhexanoic acid; and

approximately 2 mol% to 10 mol% of 3-hydroxyoctanoic acid.

27. Poly(hydroxy fatty acid) in accordance with Claim 24, characterized by the feature that the poly(hydroxy fatty acid) with the subgroup unit (C) has the following quantitative composition:

approximately 60 mol% to 80 mol% of 3-hydroxybutyric acid;

approximately 2 mol% to 10 mol% of 3-hydroxyhexanoic acid; approximately 15 mol% to 30 mol% of 5-hydroxyhexanoic acid; and

approximately 1 mol% to 5 mol% of 3-hydroxyoctanoic acid.

28. Poly(hydroxy fatty acid) in accordance with Claim 24, characterized by the feature that the poly(hydroxy fatty acid) with the subgroup unit (D) has the following quantitative composition:

approximately 30 mol% to 50 mol% of 3-hydroxybutyric acid;

approximately 10 mol% to 30 mol% of 3-hydroxyvaleric acid; approximately 15 mol% to 35 mol% of 3-hydroxyhexanoic acid;

approximately 1 mol% to 10 mol% of 3-hydroxyheptanoic acid;

approximately 1 mol% to 10 mol% of 4-hydroxyheptanoic acid; and

approximately 1 mol% to 10 mol% of 3-hydroxyoctanoic acid.

29. Poly(hydroxy fatty acid) in accordance with Claim 24, characterized by the feature that the poly(hydroxy fatty acid) with the subgroup unit (E) has the following quantitative composition:

approximately 65 mol% to 85 mol% of 3-hydroxybutyric acid;

approximately 15 mol% to 30 mol% of 3-hydroxyhexanoic acid; approximately 1 mol% to 5 mol% of 3-hydroxyoctanoic acid; and

approximately 0.5 mol% to 5 mol% of 4-hydroxyoctanoic acid.

30. Poly(hydroxy fatty acid) in accordance with Claim 24, characterized by the feature that the poly(hydroxy fatty acid) with the subgroup unit (F) has the following quantitative composition:

approximately 50 mol% to 80 mol% of 3-hydroxybutyric acid;

approximately 3 mol% to 10 mol% of 3-hydroxyhexanoic acid; and

approximately 10 mol% to 30 mol% of 5-hydroxyhexanoic acid.